ABSTRACT

A first-order perturbation theory similar to the one widely used in quantum mechanics is developed for transverse-electric and transverse-magnetic photonic resonance modes in a dielectric microsphere. General formulas for the resonance frequency shifts in response to a small change in the exterior refractive index and its radial profile are derived. The formulas are applied to two sensor applications of the microsphere to probe the medium in which the sphere is immersed: a refractive index detector; and a refractive index profile sensor.